

APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC-1997-007

TITLE HOISTING THE INTEGRATED EQUIPMENT ASSEMBLY (IEA) USING THE CARGO ELEMENT LIFTING
ASSEMBLY (CELA)

DOCUMENT NUMBER/TITLE L5166 - Cargo Element Lifting Assembly - O&C/SSPF
EID-03094 - Cargo Element Move Procedure

PREPARED BY Greg Rozewski

DATE 11/20/97

REQUIRED APPROVAL

CONTRACTOR	<u> </u> DESIGN	<u> </u> R & QA	<u> X </u> OPERATIONS	<u> X </u> SAFETY
NASA	<u> </u> DESIGN	<u> </u> R & QA	<u> X </u> OPERATIONS	<u> X </u> SAFETY

TYPE OR PRINT NAME	SIGNATURE	ORGN.	DATE
R. Gates	<i>Rene C. Gates</i>	BD-84	12/1/97
S. Kisner	<i>W. Scott Kisner</i>	F272	1 Dec 97
W. Metcalfe	<i>Wayne Metcalfe</i>	FA-31	12-2-97
M. Glenn	<i>Malcolm Glenn</i>	EI-C-A	12/15/97
D. Frank	<i>Malcolm Glenn for Telecom</i>	EI-C	12/15/97
R. Gillett	<i>John C. Dillberg for</i>	EI-F	12/15/97

CONTRACTOR DIRECTOR OF SAFETY

NASA SUSPENDED LOAD OPERATION ANALYSIS/APPROVAL

**NUMBER: SLO-KSC-1997-007
December 97
PAGE 1 OF 5**

OPERATIONS

Hoisting the Integrated Equipment Assembly (IEA) into or out of the IEA rotating dolly utilizing the Cargo Element Lifting Assembly (CELA) located in the Space Station Processing Facility (SSPF).

SUPPORTING DOCUMENTS - The associated operational procedures and System Assurance Analysis (SAA) are as follows:

- OMI L5166, Cargo Element Lifting Assembly - O&C/SSPF
- EID- 03095, Cargo Element Move Procedure
- SAA21CRS1-001, 30 Ton Highbay Bridge Cranes - Space Station Processing Facility (SSPF)

GENERAL DESCRIPTION

The IEA is hoisted into and out of the rotating dolly periodically throughout the 4A prelaunch processing flow. The current processing flow identifies moves occurring at the following times:

- 1) Initial receipt of the IEA into the dolly
- 2) Movement of the IEA into the CEWS to support integrated test
- 3) Movement of the IEA back to the dolly for radiator and solar array installation
- 4) Movement of the IEA back to the CEWS for final integration

These tasks are performed using the following procedures:

- OMI L5166, Install/Remove Payload into/from TS (Test Stand), TSF (Trunnion Support Fixture), Canister, or Payload Transporter
- EID-03094, Cargo Element move procedure sequence 02

During these operations, the following operation has been identified as requiring working under a suspended load:

1. Keel pin spherical bearing installation and removal

1. Just prior to the IEA being seated in the rotating dolly, a spherical bearing must be slid onto the keel pin. Two (2) technicians and one (1) engineer will be required to work under the suspended load (CELA and IEA) to slide the bearing onto the keel pin and torque a securing clamp in place. The technicians will then help guide the bearing into its receiving mounting bracket on the dolly as the IEA is lowered into place. This procedure must also be performed in reverse anytime the IEA is removed from the dolly.

RATIONALE/ANALYSIS - The suspended load task complies with the NASA Alternate Safety Standard as follows:

Alternate Standard Requirement #1a - This operation cannot be conducted without placing personnel under the suspended load. By its nature, the keel pin is located on the bottom of the IEA. The CELA is the only handling device with the capacity to accommodate hoisting the IEA.

The operation identified has been evaluated for alternate methods to complete the task, and it has been determined that there are no design, operational, or procedural means to eliminate personnel exposure to a suspended load.

Alternate Standard Requirement #1b - The possible use of a secondary support system, to catch the load in the event of a crane failure, was analyzed. The suspended load operation is performed with the IEA suspended approximately 12"-18" above the dolly trunnion support fittings. The fittings provide a certain amount of secondary support capability in the event of a crane failure. The fittings will be directly beneath the trunnions and could capture a descending IEA provided alignment between the two could be maintained. The use of any other secondary support system was determined not feasible due to the magnitude of the load and the narrow clearances between the IEA and dolly.

Alternate Standard Requirement #1c - The maximum number of personnel permitted under the suspended load (CELA and IEA) for the operation is limited to the two technicians necessary to complete the task and one engineer to disposition any anomalies encountered during the task.

Alternate Standard Requirement #1d - Performing the operation will be accomplished as quickly and safely as possible to minimize exposure time. The approximate time for the suspended load (CELA and IEA) operation is listed below.

1. Keel spherical bearing installation/removal 30 minutes

Alternate Standard Requirement #4 - EID-03095 has the appropriate WARNING statement in it immediately prior to the suspended load operation. The statement limits the number of personnel under the suspended load to the two technicians and one engineer. The EID is available on site for inspection during the operation.

Alternate Standard Requirement #6 - The suspended load operation addressed in this analysis involves one of the 30 ton SSPF bridge cranes. The cranes are designed, tested, inspected, maintained, and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9.

The SSPF 30 ton crane hoists are equipped with two magnetic holding brakes, each capable of holding the load up to the crane's rated capacity. Each brake's ability to hold the rated load (30 tons) is verified annually. The cranes are designed to meet a 5 to 1 safety factor based on ultimate strength for the hoist load bearing components. The 30 ton cranes are load tested annually at 100% of rated capacity. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on the cranes to ensure proper operation. A detailed inspection of the lifting slings is performed annually. Nondestructive testing of the slings and crane hooks is performed annually.

The Cargo Element Lifting Assembly (CELA) has a safe working load of 36,500 lbs. and is designed to meet a 5 to 1 safety factor based on ultimate strength. The maximum weight of the IEA is approximately 24000 lbs.

Alternate Standard Requirement #7 - An SAA has been completed on the 30 ton bridge cranes in the SSPF. The SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis (see supporting documents). No critical single failure points were identified during this analysis.

Alternate Standard Requirement #8 - Visual inspections for cracks or other signs of damage or anomalies are performed on the hoist hooks, hoist beams, hoist cables, hoist rod assemblies, and hoist fittings, and crane functional checks are performed before each operation per NSS/GO-1740.9.

Alternate Standard Requirement #9 - Trained and licensed crane operators shall remain at the hoist controls while personnel are under the load.

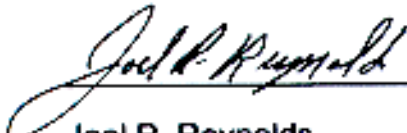
Alternate Standard Requirement #10 - Appropriate safety control areas are established before initiating operations. Only the minimum number of people (manloaded in the procedure) will be permitted in this area.

Alternate Standard Requirement #11 - A pretask briefing and a safety walkdown of the area are conducted prior to the lift to ensure that all systems and personnel are ready to support. All participants are instructed on their specific tasks and warned of any hazards involved. Following any crew change, the new personnel are instructed by the task leader on their specific tasks and warned of any hazards involved.

Alternate Standard Requirement #12 - The personnel under the suspended load will be in voice contact with the hoist operator and/or task leader. Upon loss of communication, the operation shall stop immediately, personnel shall clear the hazardous area, and the load shall be safed. Operations shall not continue until communications are restored.

Alternate Standard Requirement #13 - Personnel working beneath the load shall be in continuous sight of the hoist operator and/or task leader.

APPROVAL: DATE:

 12/15/97

Joel R. Reynolds
Director, Safety Assurance
Kennedy Space Center